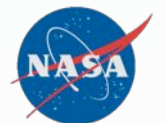




Explorer POST 630 Flight Mission Review





Advisors' Goal

Test - Confirmation

Build-Engineering/Communication Skills

Design-Math/Physics Basics





+Mission Requirement

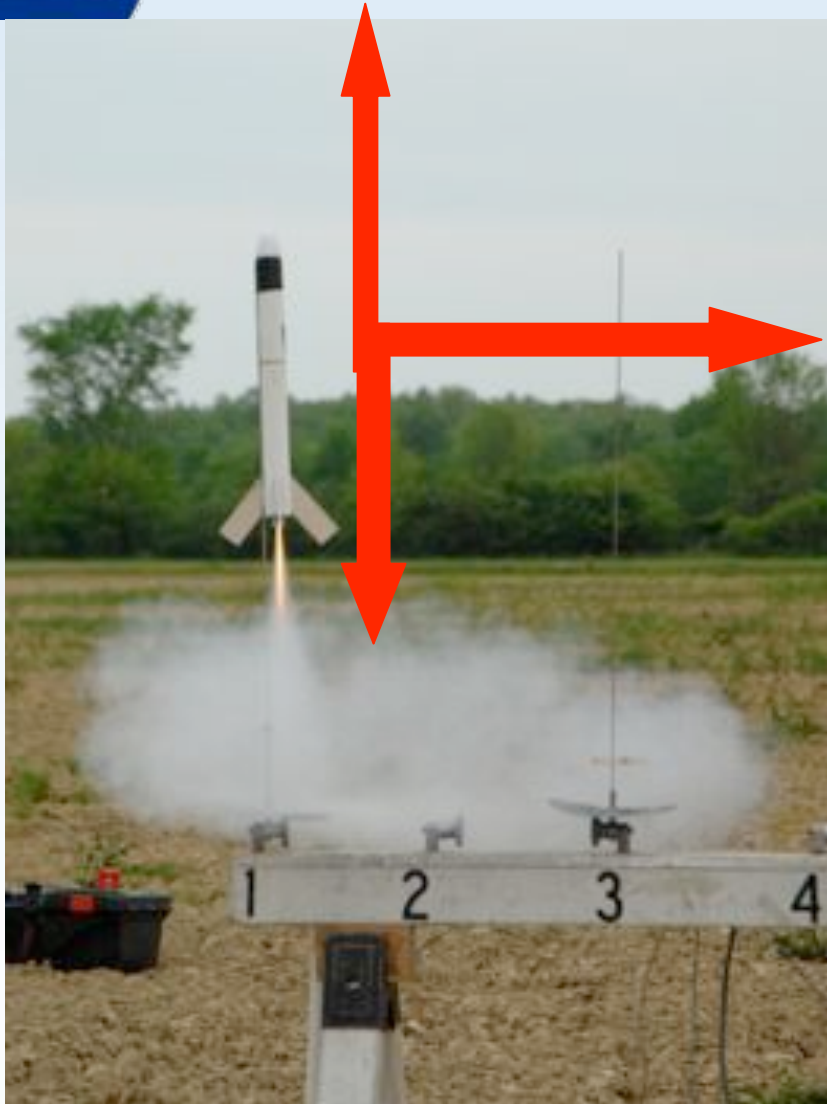


- Must have a design sketch
- Must have performance estimates
- Must have make a case on how you team will achieve 'steady' side, top and bottom video.
- Must work as a team.
- Must pass a design review





+Mission Requirement



- Ascent and Decent !
- BUT does NOT have to occur on one launch



Designing Mission



- **Post Design Mission: Design and Build a Vehicle with predicted Altitude Performance and a loft time performance.**
- Understand the basic build and test - Bridge building
- Discussion of Vehicle and Vehicle Propulsion System
- Initially, the groups worked on preliminary vehicle designs on paper and on computer simulations.
- The design process included making sketches of our rockets' tentative designs, estimating the size and weight of the rockets, and estimating how high our rockets might fly.





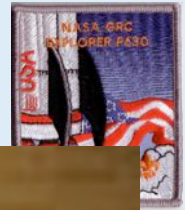
Lessons Learned



- Melted 6 parachutes performed 10 successful launches ! (3 Altimeter data points)
- All rockets recovered
- All of them flew straight !
- Congratulation to all for job well done!



Building the Rockets cont.



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WYLTK Green Shoes

Alex Brown
Nikita Jackson
Emily Kollin



Glenn Research Center at Lewis
Field

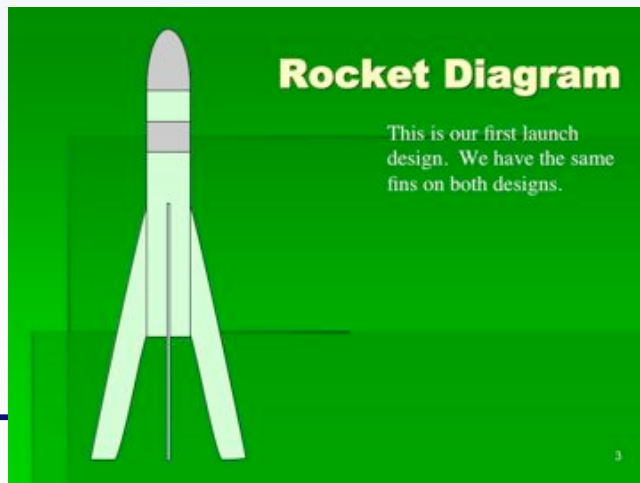


WYLTK

Final Design

Matches the design parameters

Green matches the presentation background
(missing member wore green shoes)



Glenn
Field





WYLTK

- Initial design/built iteration
- Payload capability?
- Uncertainty about the design?
- Advisor guidance toward narrower body. (Less Drag?)





Rocket Power (Rock-a-ware)

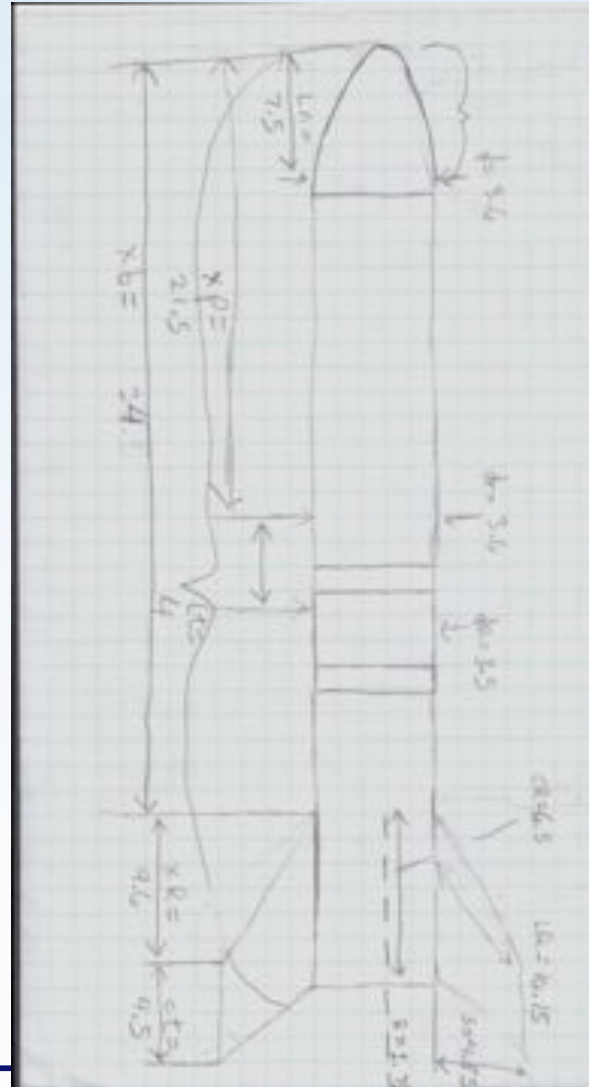


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Rocket Power

- Designed by team and colored Cierra.
- Built in payload capability.
- Issues with building techniques.





Silver Bullet



National Aeronautics and Space Administration



The Silver Bullet

Joseph Baz
Jake Del Valle
Mike Szabo



Glenn Research Center at Lewis
Field



Silver Bullet

- No silver paint.
- Lost the advisor in the middle
- “unattempted excellence”
- Tapered body style.
 - Felt like having the design





Echo 419



National Aeronautics and Space Administration



Echo 419

Acme Inc.

Anthony
Jim
Bart
David



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Echo 419

- Original design is built
- “Orange is the fastest color”
- Thickest fin





Summary (Design vs. Actual)



Design			Predicted					Measured					
	motor	length (cm)	CG (in)	CG (cm)	CP (in)	CG (cm)	Weight (w/o motor)	CG (in)	Cg (cm)	CP (in)	Cp (cm)	Weight (g w/o alt)	Weight (g)
WYLTK -1			5.2		3.4		90.8	62	3.4		5.38		69.6
WYLTK -2	c6-5	25.4	5.7		4.2		62		3.3		1.78		69.8
Acme Inc (echo 419)		42		23		27		73.6	12.6		7.4		95
Silvet Bullet	C6-5	50		18.4		22.8	110	92	23.7		14.75		92
Rocket Power		40.5				32	70.4	41.8	17.5		19.5		88





WYLK-2



- Longest time Aloft @ 79 sec Average.
- Eventually worked as designed. (2 parts to land)



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Field





Silver Bullet



- Closest to original design Conditions





Rocket Power (Rock-a-ware)



- Highest altitude achieved (both measurements)





Rocket Power (Rock-a-ware)



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Echo 419



- Closest to the Design Prediction (227 ft vs. 210 ft and 26 sec vs. 28 sec)

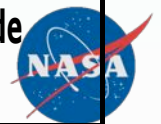


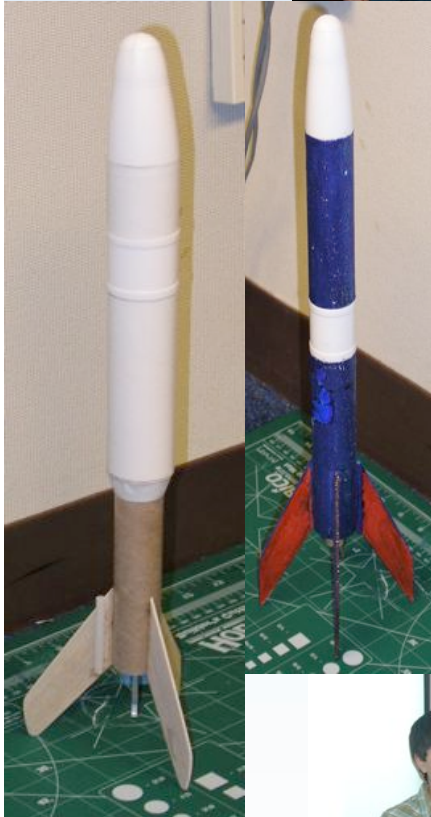


Summary (Design vs. Actual)



Design		Predicted		Measured			Comment
	length motor (cm)	Altitude (ft)	Time	Altimeter	Calculated Altitude	Time	
WYRLRK -1		928.5	22	290	196.3	29	
"					280.6	28	
WYRLRK -2 c6-5	25.4	537	13		567.1	79	Longest time aloft
Acme Inc (echo 419)	42	227	28		209.7	26	Closted to their design prediction
				569	451.8	56.5	
Silvet Bullet C6-5	50	460	57		447.1	29	most accurate altitude prediction
Rocket Power	40.5	309	20	598	470.2	35	Highest recorded altitude
Glenn Research Center at Lewis Field					158	30	





Glenn Research C
Field

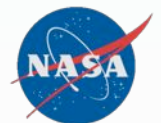




Designing Mission



- **Post Design Mission: obtain video data from a small launch vehicle**
- Understand the basic build and test - Bridge building
- Discussion of Vehicle and Vehicle Propulsion System
- Initially, the groups worked on preliminary vehicle designs on paper and on computer simulations.
- The design process included making sketches of our rockets' tentative designs, estimating the size and weight of the rockets, and estimating how high our rockets might fly.





Advisor Comments/Lessons learned



- 7 successful launches ! (3 Video Data)
- All student built rockets recovered (not all in one piece)
- Only one flew straight !
- Size limitation for the payload was little too conservative !
- Congratulation to all for job well done!
- Thanks goes to SkyBusters

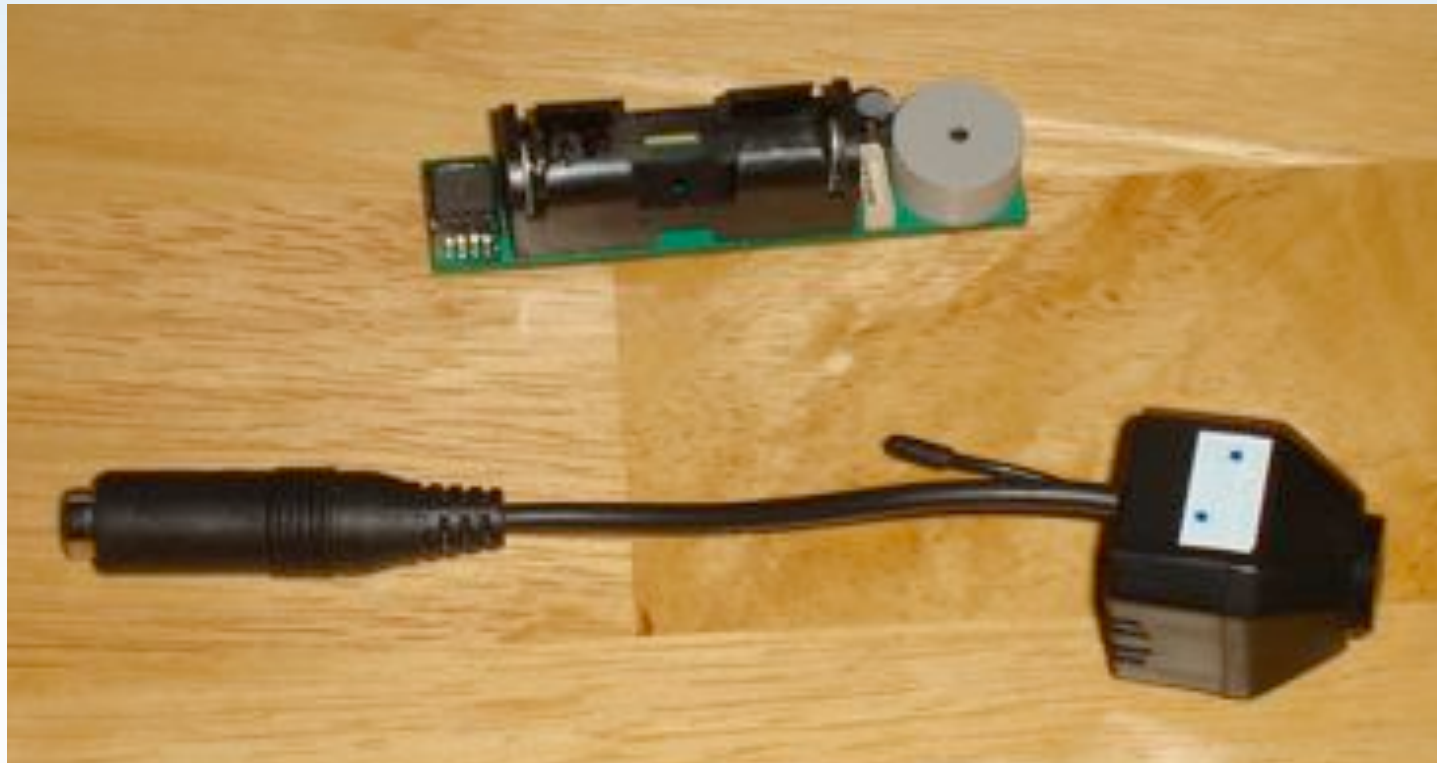




Building the Rockets

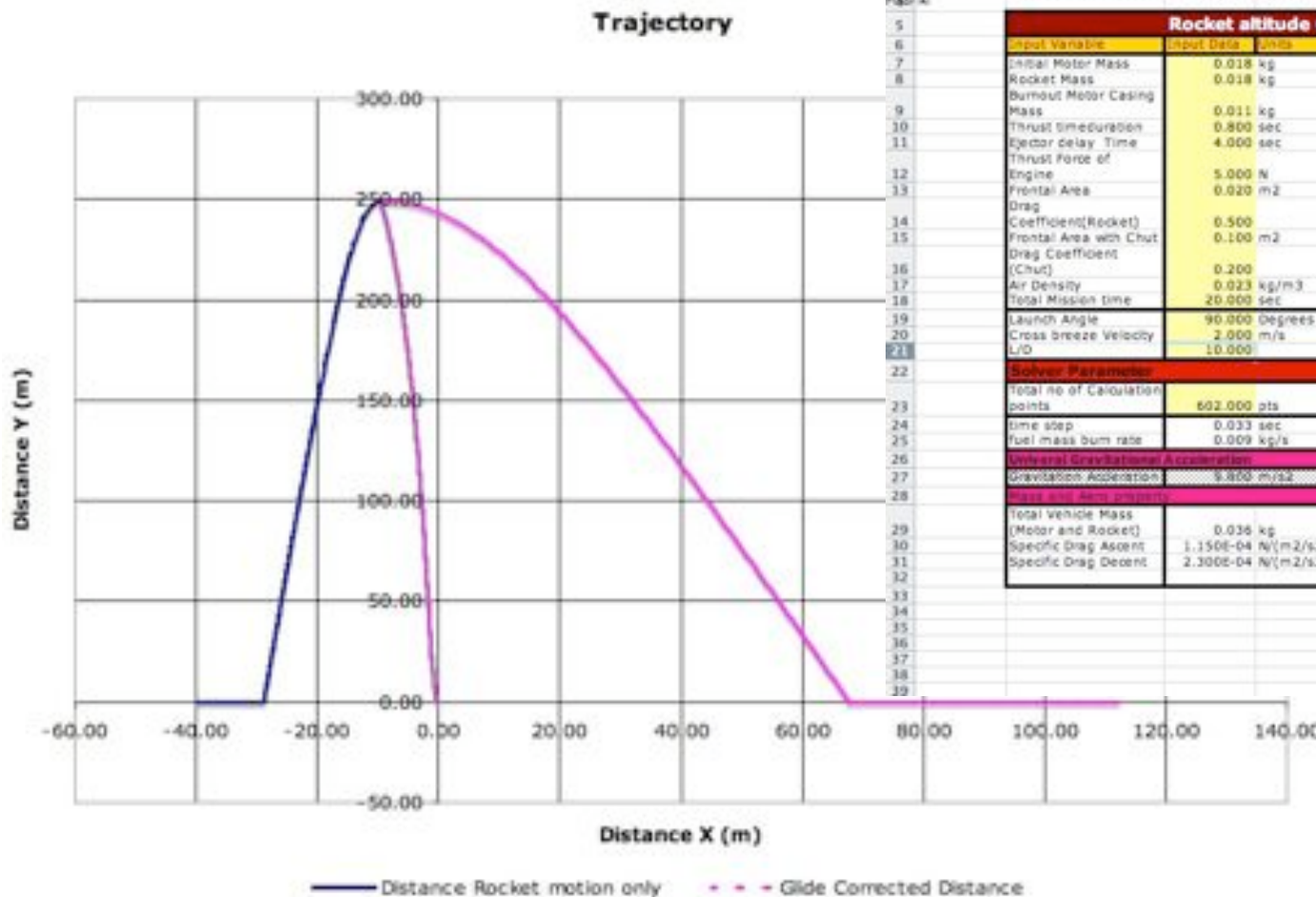


- Data gathering systems
- Miniature video system and an altimeter.





Rocket Trajectory Model



The Shaded cells need user input

Rocket altitude Calculations				
Input Variable	Input Data	Units	Converted Data	Converted Unit
Initial Motor Mass	0.018	kg	0.008	lbm
Rocket Mass	0.018	kg	0.008	lbm
Burnout Motor Casing Mass	0.011	kg	0.005	lbm
Thrust time/duration	0.800	sec	0.800	sec
Ejector delay Time	4.000	sec	4.000	sec
Thrust Force of Engine	5.000	N	22.250	lbf
Frontal Area	0.020	m ²	0.215	ft ²
Drag				
Coefficient(Rocket)	0.500			
Frontal Area with Chut	0.100	m ²	1.076	ft ²
Drag Coefficient (Chut)	0.200			
Air Density	0.023	kg/m ³	0.001	lbm/s
Total Mission time	20.000	sec	20.000	sec
Launch Angle	90.000	Degrees	1.571	rad/rads
Cross breeze Velocity	2.000	m/s		ft/s
L/D	10.000			
Solver Parameter				
Total no of Calculation points	602.000	pts		
time step	0.033	sec		
Fuel mass burn rate	0.009	kg/s	0.020	lbm/s
Universal Gravitational Acceleration				
Gravitation Acceleration	9.800	m/s ²	32.200	ft/s ²
Mass and Area property				
Total Vehicle Mass (Motor and Rocket)	0.036	kg		
Specific Drag Ascent	1.150E-04	N/(m ² /s ²)		
Specific Drag Decent	2.300E-04	N/(m ² /s ²)		





Measured Motor Data for Rocket Model



Thrust Data





Test, Test and more Test



- Based on past experience of recovery chute failure
- Ground tested the recovery system

